

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

1. (Previously Presented) A micro-relay comprising:
 - a first substrate having stationary contacts and a stationary electrode;
 - a second substrate, having a stationary contact, arranged so as to face the first substrate; and
 - a movable plate arranged between the first and second substrates, the movable plate comprising:
 - a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
 - a movable portion parallel relative to the first and second substrates, and
 - a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
 - the movable portion having a movable electrode facing the stationary electrode, and
 - multiple movable contacts facing the stationary contacts,
 - the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
 - wherein the stationary contacts have branch portions that are contactable to the multiple movable contacts,
 - the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
 - when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrates, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

5. (Previously Presented) The micro relay according to claim 1:
 - wherein the stationary contacts that are contactable to the multiple movable contacts are provided independently.

6. (Previously Presented) The micro-relay as claimed in claim 68, wherein the first substrate has through holes via which interconnection lines extending from the first substrate are extracted to an outside of the micro-relay.

7. (Previously Presented) The micro-relay as claimed in claim 68, wherein the first substrate has through holes via which interconnection lines extending from the movable plate are extracted to an outside of the micro-relay.

8. (Previously Presented) The micro-relay as claimed in claim 68, wherein interconnection lines extending from the first substrate to an outside of the micro-relay are flush with a surface of the first substrate.

11. (Previously Presented) The micro-relay as claimed in claim 68, wherein the hinge springs are arranged symmetrically.

15. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate, having a stationary contact, arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein at least one of the frame and the movable portion has a stopper that restricts in-plane movement of the movable portion,
the multiple movable contacts are located between the stationary contacts without

making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

18. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate, having a stationary contact, arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising: a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein the movable portion has protrusions that prevent the movable portion from sticking to the first substrate,
the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

22. (Previously Presented) The micro-relay as claimed in claim 68, wherein the second substrate has a flat plate shape.

24. (Previously Presented) A micro-relay comprising:

a first substrate having stationary contacts and a stationary electrode;
a second substrate, having a stationary contact, arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein the second substrate has a stationary contact facing the movable contact,
the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

27. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,

wherein the second substrate has a stationary contact and stationary electrodes that face the movable contact,

the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

30. (Previously Presented) A micro-relay comprising:

a first substrate having stationary contacts and a stationary electrode;

a second substrate arranged so as to face the first substrate; and

a movable plate arranged between the first and second substrates,

the movable plate comprising:

a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,

a movable portion parallel relative to the first and second substrates, and

a plurality of hinge springs movably suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,

the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,

the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,

wherein the second substrate has a stationary electrode that faces the movable electrode, and a stationary contact that faces the movable contact,

the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

31. (Previously Presented) A micro-relay comprising:

a first substrate having stationary contacts and a stationary electrode;

a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein:
the second substrate has a stationary electrode that faces the movable electrode, and a stationary contact that faces the movable contact; and
the movable contact is separated from the stationary contacts of the first and second substrates in the absence of electrostatic attraction,
the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

32. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a

movable contact facing the stationary contacts,

the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,

wherein:

the second substrate has a stationary electrode that faces the movable electrode, and a stationary contact that faces the movable contact;

the movable contact is separated from the stationary contacts of the first and second substrates in the absence of electrostatic attraction; and

the movable contact is brought into contact with the stationary electrode of the second substrate or the stationary contacts of the first substrate due to electrostatic attraction,

the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

33. (Previously Presented) A micro-relay comprising:

a first substrate having stationary contacts and a stationary electrode;

a second substrate arranged so as to face the first substrate; and

a movable plate arranged between the first and second substrates,

the movable plate comprising:

a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,

a movable portion parallel relative to the first and second substrates, and

a plurality of hinge springs movably suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,

the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,

the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,

wherein:

the second substrate has a stationary electrode that faces the movable electrode, and stationary contacts that face the movable contact; and

the movable contact is separated from the stationary contacts of the first and second

substrates in the absence of electrostatic attraction,

the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

34. (Previously Presented) A micro-relay comprising:
- a first substrate having stationary contacts and a stationary electrode;
 - a second substrate, having a stationary contact, arranged so as to face the first substrate and having stationary contacts; and
 - a movable plate arranged between the first and second substrates, the movable plate comprising:
 - a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
 - a movable portion parallel relative to the first and second substrates, and
 - a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
 - the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
 - the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
 - wherein the stationary contacts of the first substrate are for use in signal transmission, and the stationary contacts of the second substrate are for use in signal transmission,
 - the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
 - when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

35. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate, having a stationary contact, arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein the second substrate has a stationary electrode, and an interconnection line extending from the stationary electrode of the second substrate is extracted to an outside of the micro-relay via a through hole formed in the second substrate,
the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

36. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,

the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,

wherein the second substrate has a stationary contact facing the movable contact, and

wherein an interconnection line extending from the stationary contact is extracted to an outside of the second substrate via a through hole formed in the second substrate,

the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

37. (Previously Presented) A micro-relay comprising:

a first substrate having stationary contacts and a stationary electrode;

a second substrate arranged so as to face the first substrate; and

a movable plate arranged between the first and second substrates,

the movable plate comprising:

a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,

a movable portion parallel relative to the first and second substrates, and

a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,

the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,

the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,

wherein the second substrate has a stationary contact facing the movable contact, and the movable plate has protrusions that prevent the movable portion from sticking to the second substrate,

the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the

movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

38. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate comprising:
a frame sandwiched between the first and second substrates to realize a hermetical sealed structure,
a movable portion parallel relative to the first and second substrates, and
a plurality of hinge springs movingly suspending the movable portion from the frame while maintaining a parallel state relative to the first and second substrates,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein the second substrate has a stationary contact facing the movable contact, and the movable plate has protrusions that prevent the movable portion from sticking to the first and second substrates,
the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and
when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.

40. (Previously Presented) The micro-relay as claimed in claim 68, wherein the frame has a thickness that defines spaces between the movable plate and the first stationary contact and between the movable plate and the second stationary contact.

43. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate;

a movable plate arranged between the first and second substrates,
the movable plate having a frame and a movable portion,
the frame being sandwiched between the first and second substrates to realize a hermetical sealed structure,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode;
a base substrate that supports the first substrate;
members that connect the movable electrode and the stationary electrode to pads formed on the base substrate; and
resin that covers the first and second substrates and the movable plate.

44. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate having a frame and a movable portion,
the frame being sandwiched between the first and second substrates to realize a hermetical sealed structure,
the movable portion having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contacts,
the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode,
wherein the frame has a protrusion and the movable portion has a counterpart recess.

46. (Previously Presented) A micro-relay comprising:
a first substrate having stationary contacts and a stationary electrode;
a second substrate arranged so as to face the first substrate; and
a movable plate arranged between the first and second substrates,
the movable plate having a frame and a movable portion,
the frame being sandwiched between the first and second substrates to realize a hermetical sealed structure,
the movable portion having a movable electrode facing the stationary electrode, and a

movable contact facing the stationary contacts,

the movable portion moving between the first and second substrates due to electrostatic attraction that develops between the movable electrode and the stationary electrode, wherein the movable portion and the frame have an identical thickness.

68. (Previously Presented) A micro-relay comprising:

a first substrate having a contact as a stationary contact and an electrode as a stationary electrode;

a second substrate, having a stationary contact, facing the first substrate; and

a movable plate arranged between the first and second substrates,

the movable plate including:

a frame sandwiched between the first and second substrates forming a hermetical sealed structure,

a portion parallel relative to the first and second substrates having a movable electrode facing the stationary electrode, and a movable contact facing the stationary contact, and

a plurality of hinge springs movingly suspending the portion from the frame while maintaining a parallel state relative to the first and second substrates,

wherein the multiple movable contacts are located between the stationary contacts without making contact with any of the stationary contacts of the first and second substrates when a voltage is not applied between the movable electrode and the stationary electrode, and

when the multiple movable contacts are released from a connecting state in which the movable contacts make a connection with the stationary contacts of the first substrate, the movable contacts are disconnected therefrom and make a connection with the stationary contact of the second substrate that is at a ground potential.